

FIG. 1

FIG. 2

Low frequency

Horizontal high frequency

8	16	19	22	26	27	29	34
16	16	22	24	27	29	34	37
19	22	26	27	29	34	34	38
22	22	24	27	29	34	37	40
22	26	27	29	32	35	40	48
26	27	29	32	35	40	48	58
26	27	29	34	38	46	56	69
27	29	35	38	46	56	69	83

Vertical high frequency

FIG. 3

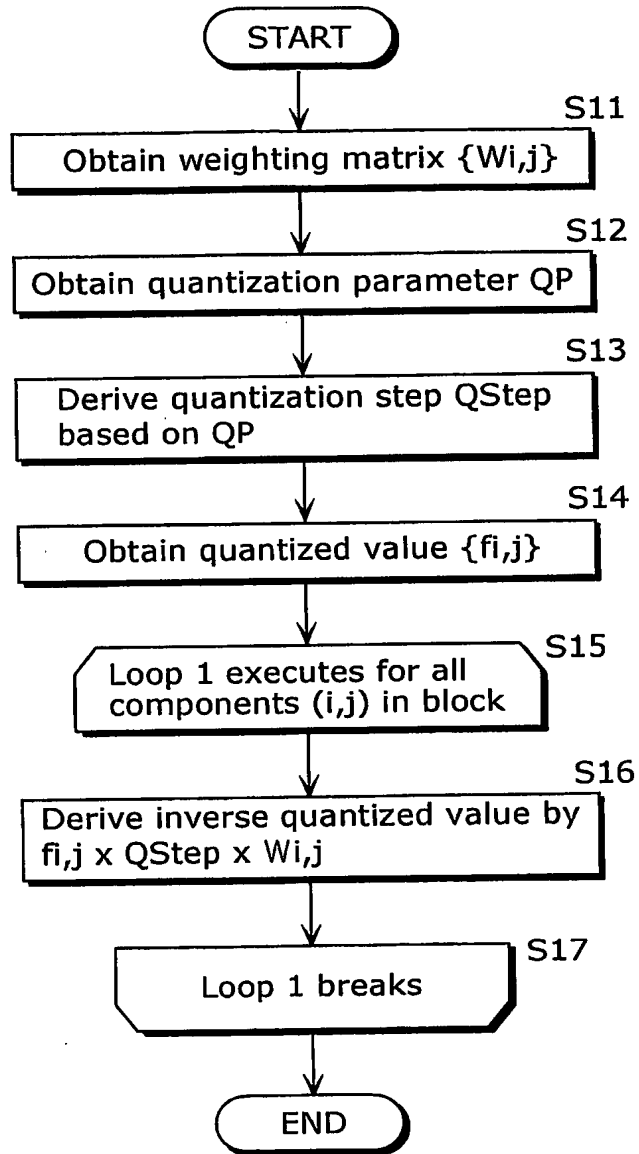


FIG. 4

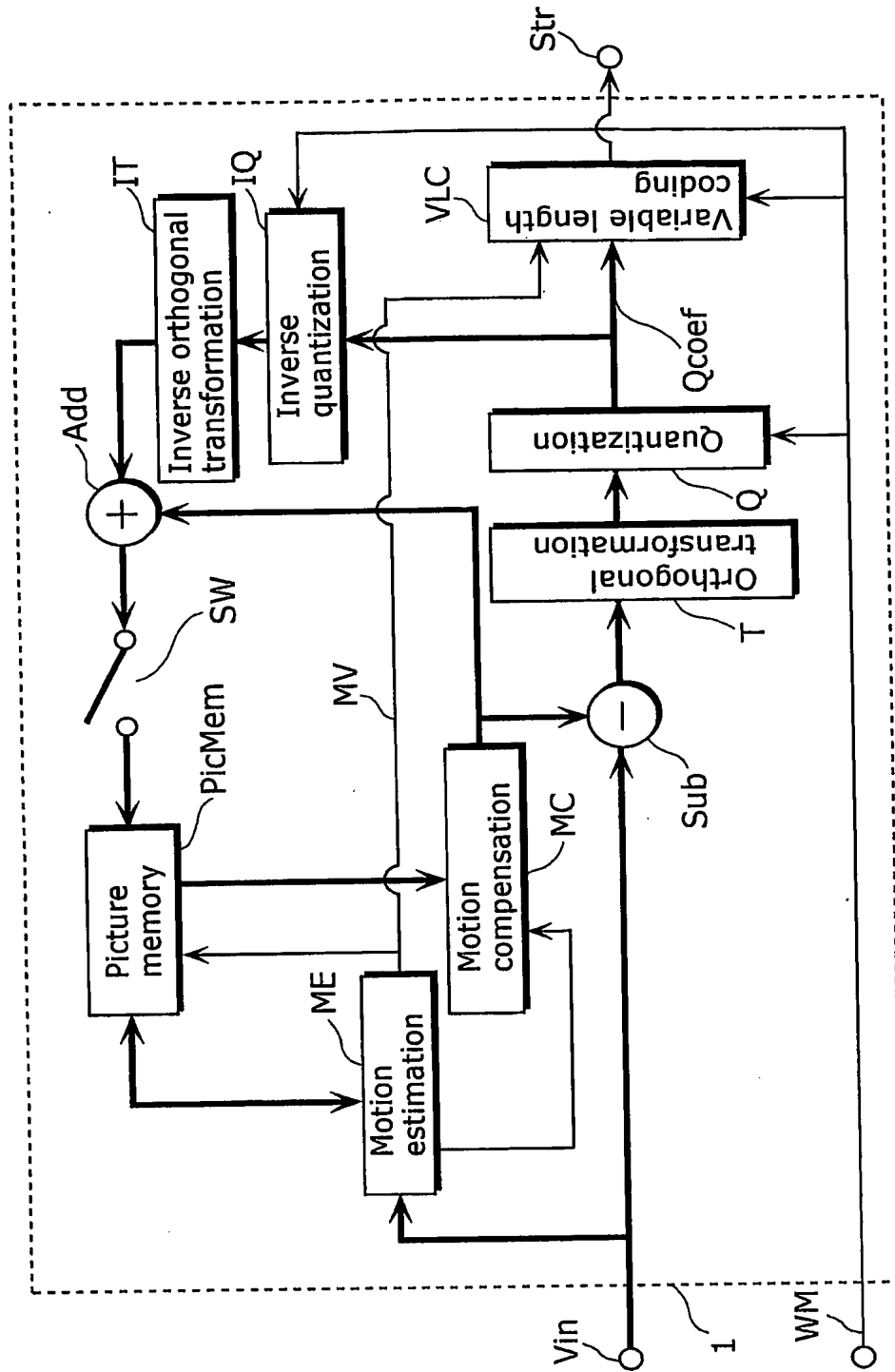


FIG. 5

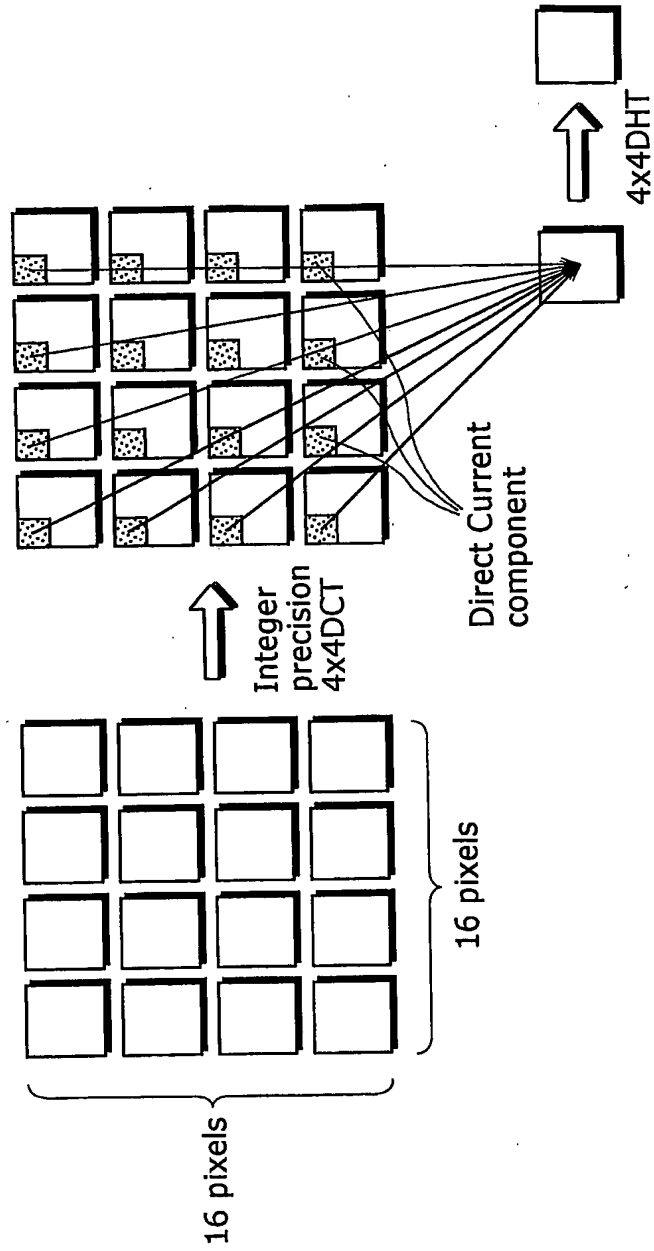


FIG. 6

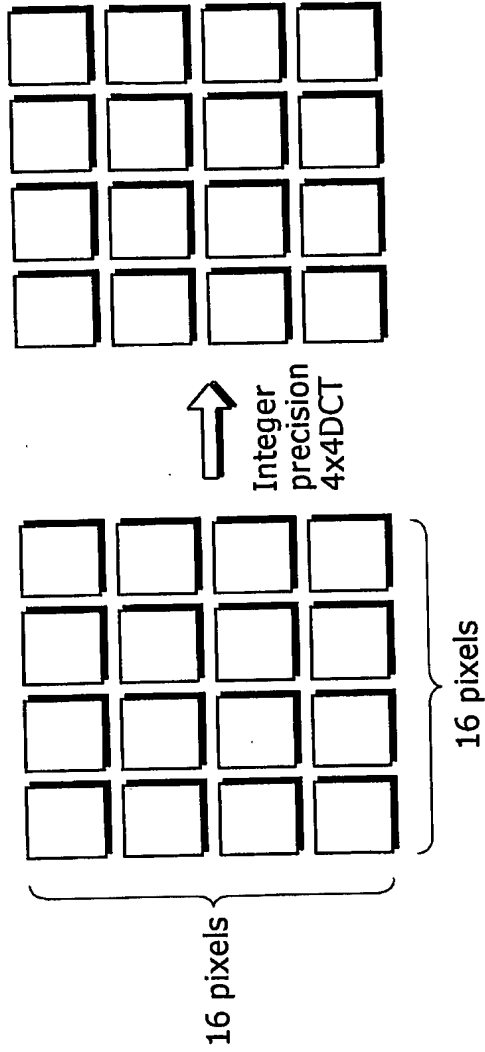


FIG. 7

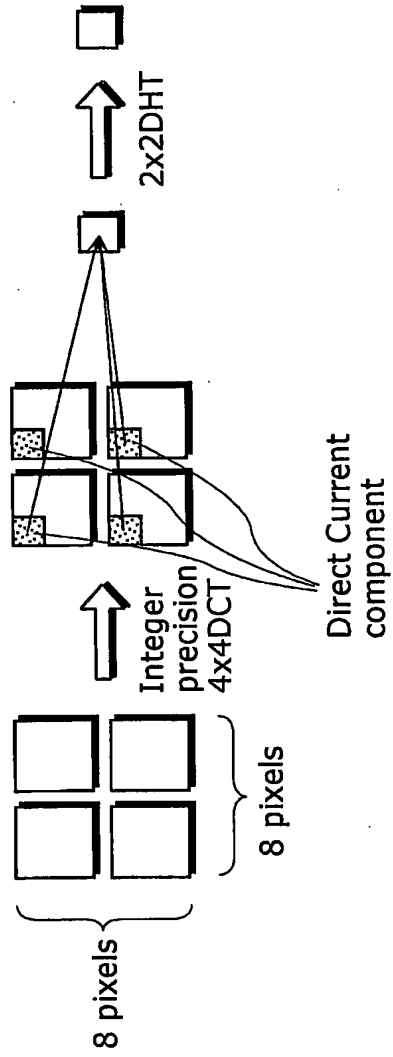


FIG. 8

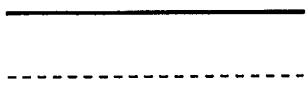
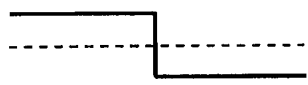
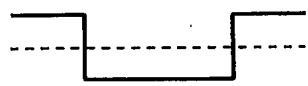
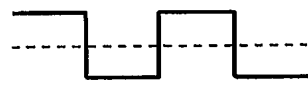
$H_0 = (h_0 + h_1 + h_2 + h_3) / 2$	
$H_1 = (h_0 + h_1 - h_2 - h_3) / 2$	
$H_2 = (h_0 - h_1 - h_2 + h_3) / 2$	
$H_3 = (h_0 - h_1 + h_2 - h_3) / 2$	

FIG. 9A


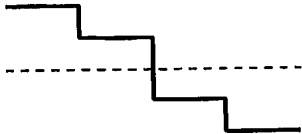
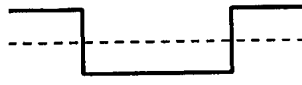
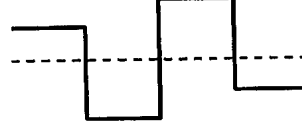
$D0 = (d0 + d1 + d2 + d3) / 2$	
$D1 = (2d0 + d1 - d2 - 2d3) / (\sqrt{10})$	
$D2 = (d0 - d1 - d2 + d3) / 2$	
$D3 = (d0 - 2d1 + 2d2 - d3) / (\sqrt{10})$	

FIG. 9B

$d0 = (D0 + D1' + D2 + D3' / 2) / 2$ $d1 = (D0 + D1' / 2 - D2 - D3') / 2$ $d2 = (D0 + D1' / 2 - D2 + D3') / 2$ $d3 = (D0 - D1' + D2 - D3' / 2) / 2$ $D1' = D1 \sqrt{8} / \sqrt{5}$ $D3' = D3 \sqrt{8} / \sqrt{5}$

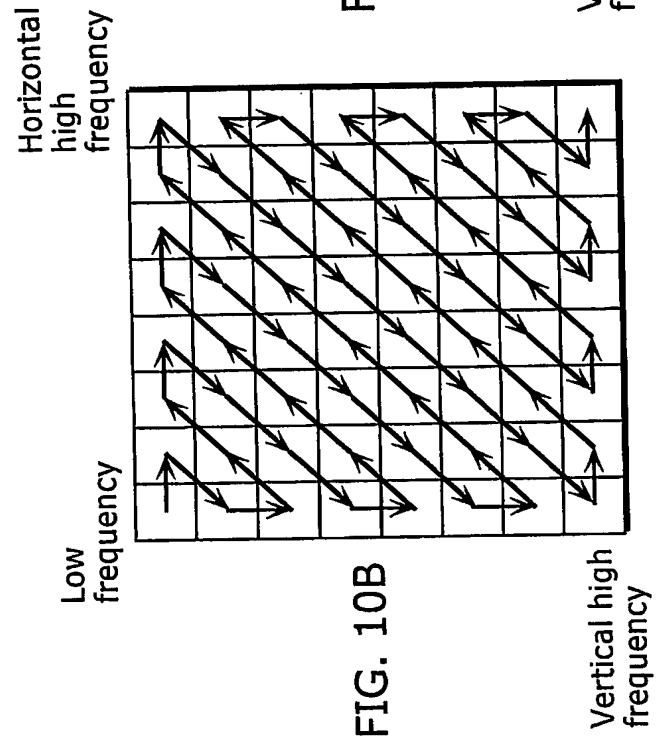
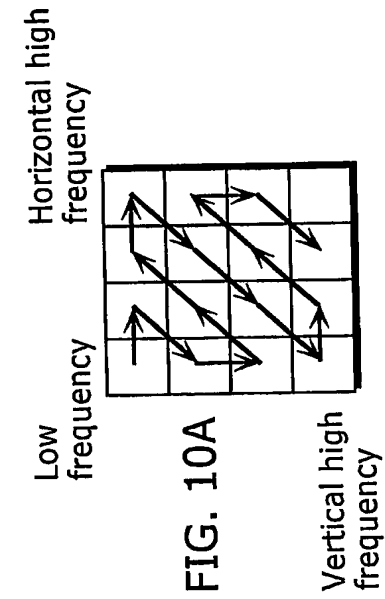
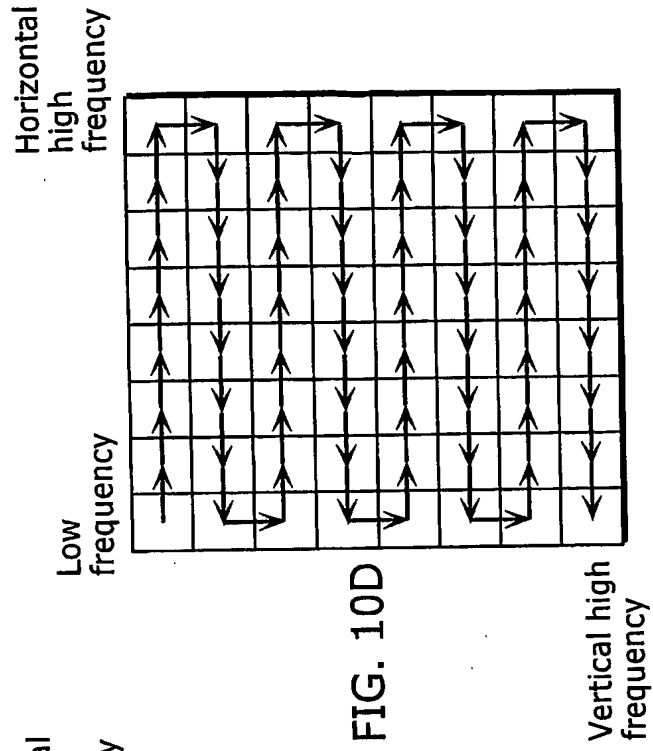
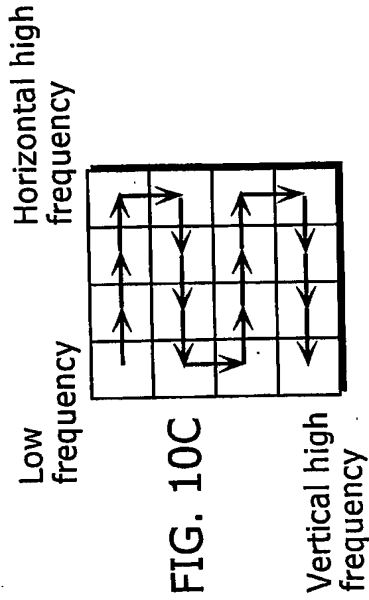


FIG. 11B

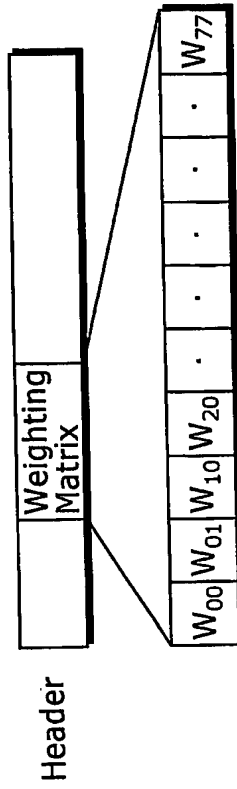


FIG. 11C

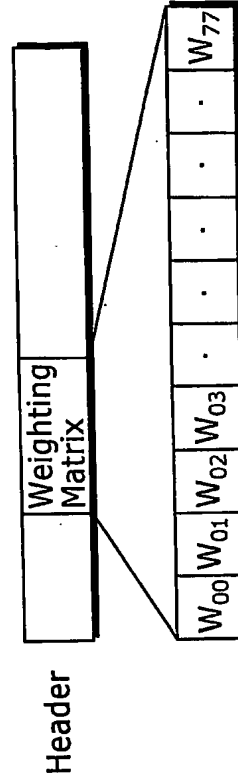


FIG. 11A

W_{00}	W_{01}	W_{02}	W_{03}	W_{04}	W_{05}	W_{06}	W_{07}
W_{10}	W_{11}	W_{12}	W_{13}	W_{14}	W_{15}	W_{16}	W_{17}
W_{20}	W_{21}	W_{22}	W_{23}	W_{24}	W_{25}	W_{26}	W_{27}
W_{30}	W_{31}	W_{32}	W_{33}	W_{34}	W_{35}	W_{36}	W_{37}
W_{40}	W_{41}	W_{42}	W_{43}	W_{44}	W_{45}	W_{46}	W_{47}
W_{50}	W_{51}	W_{52}	W_{53}	W_{54}	W_{55}	W_{56}	W_{57}
W_{60}	W_{61}	W_{62}	W_{63}	W_{64}	W_{65}	W_{66}	W_{67}
W_{70}	W_{71}	W_{72}	W_{73}	W_{74}	W_{75}	W_{76}	W_{77}

FIG. 12

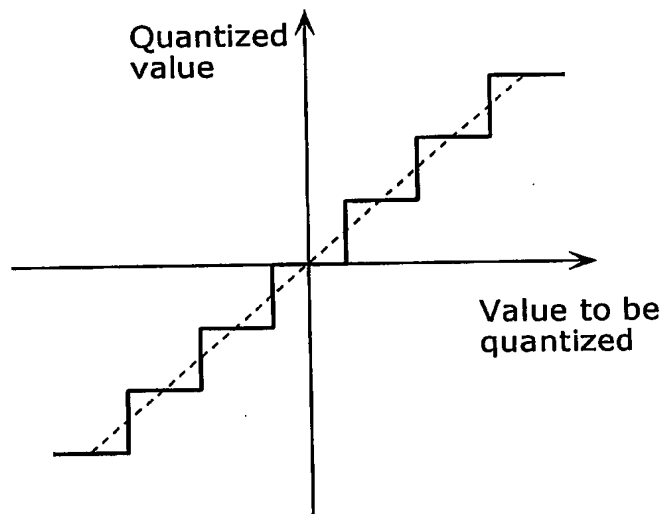


FIG. 13

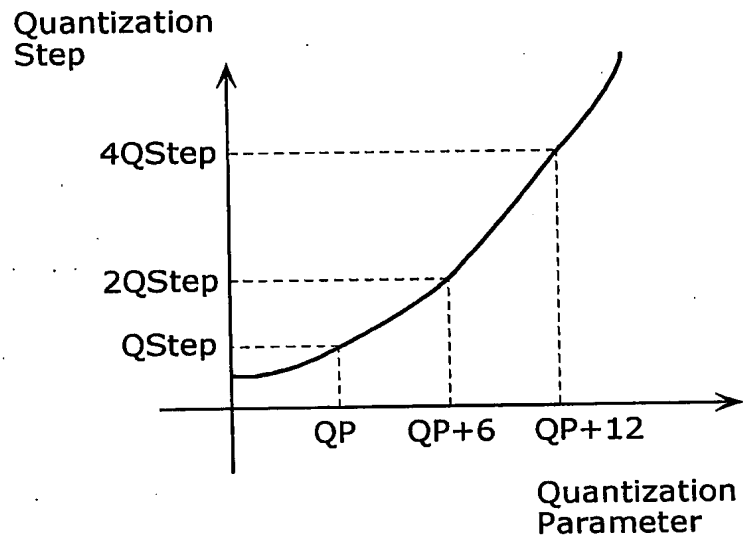


FIG. 14

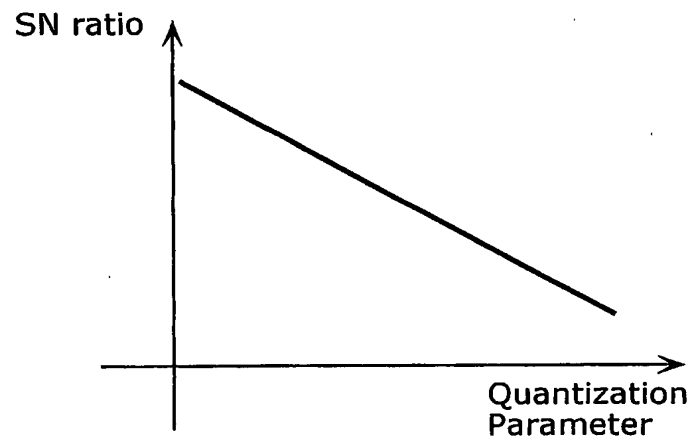


FIG. 15A

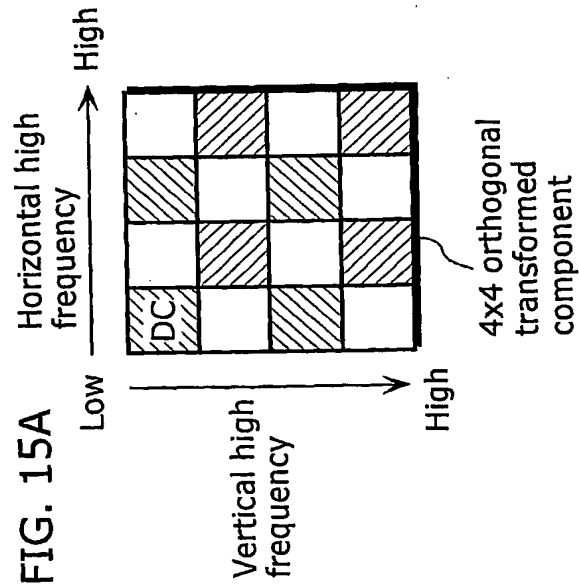


FIG. 15B




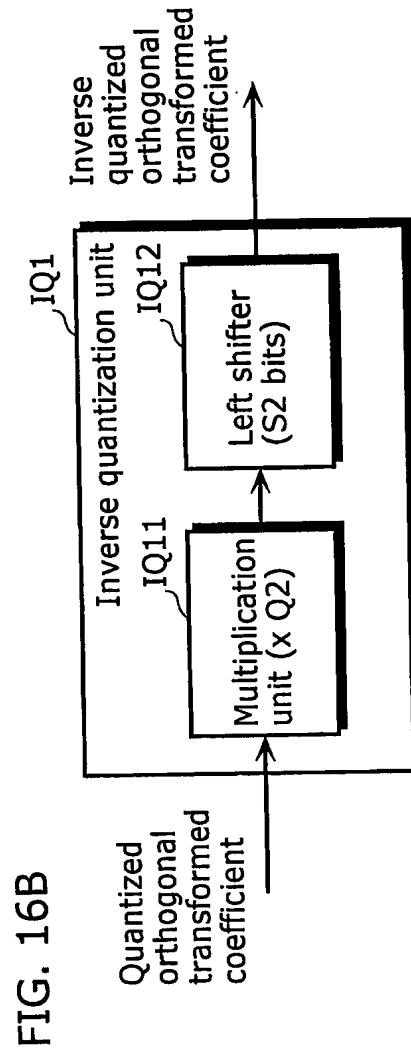
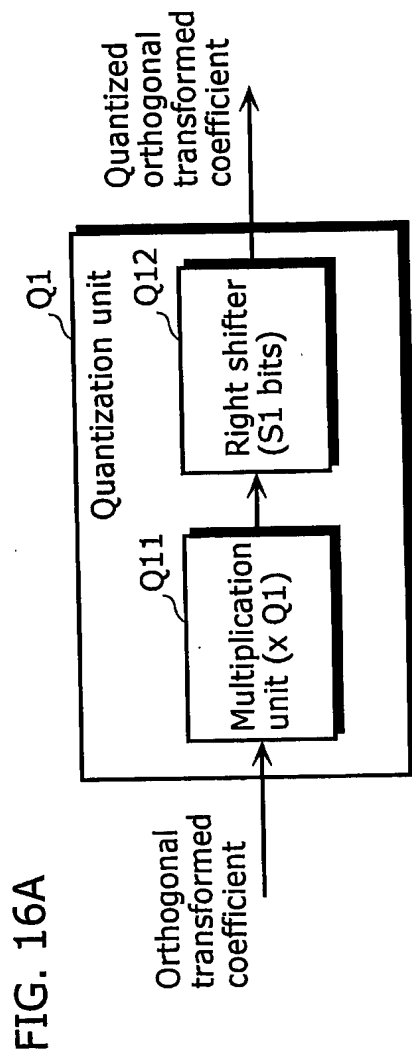
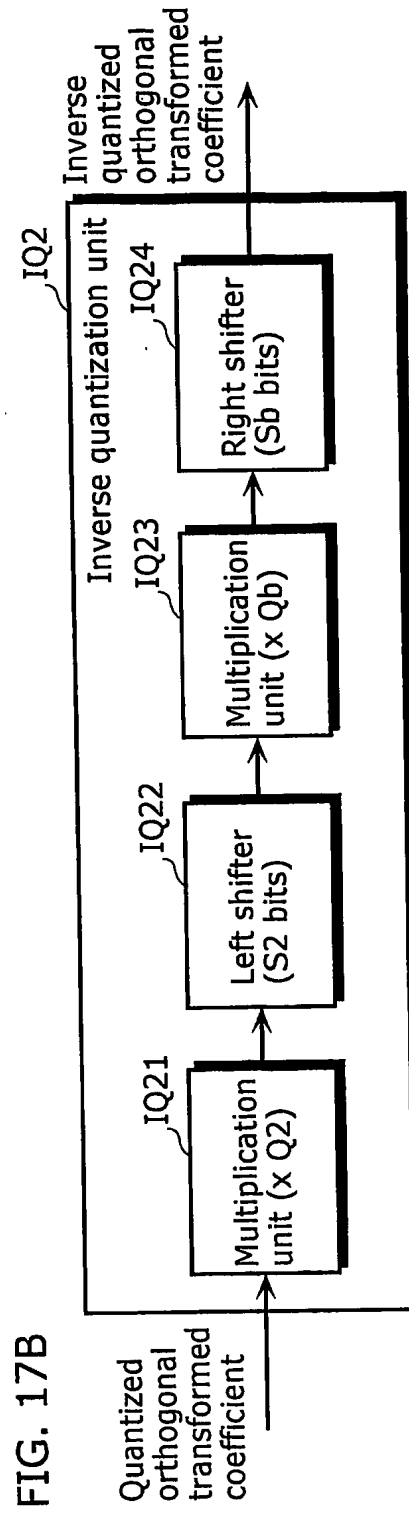
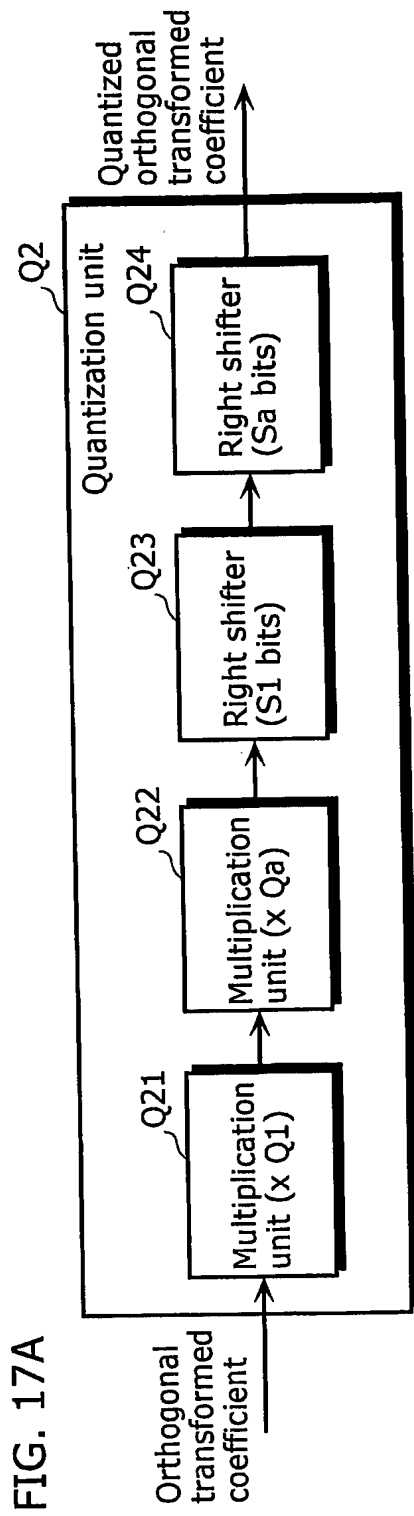
	Multiply quantization value by value obtained by multiplying value of (QP%6) in column α by $2^{QP/6}$
	Multiply quantization value by value obtained by multiplying value of (QP%6) in column β by $2^{QP/6}$
	Multiply quantization value by value obtained by multiplying value of (QP%6) in column γ by $2^{QP/6}$

FIG. 15C

QP%6	α	β	γ
0	10	16	13
1	11	18	14
2	13	20	16
3	14	23	18
4	16	25	20
5	18	29	23





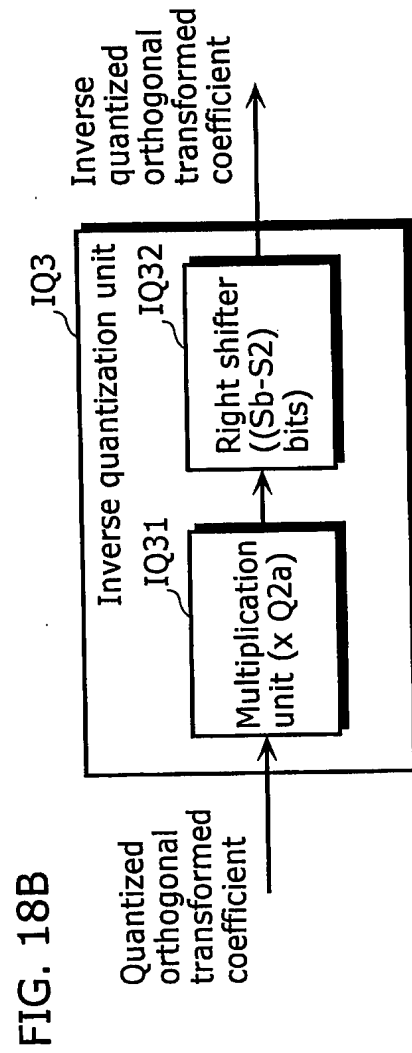
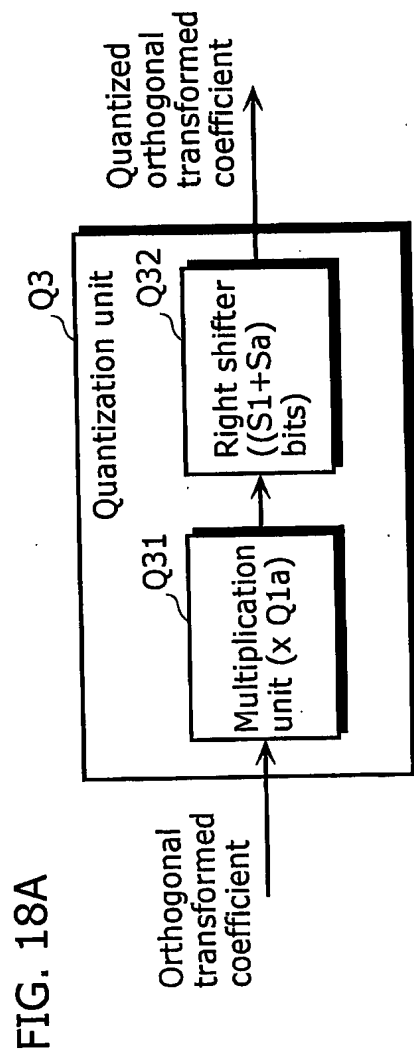
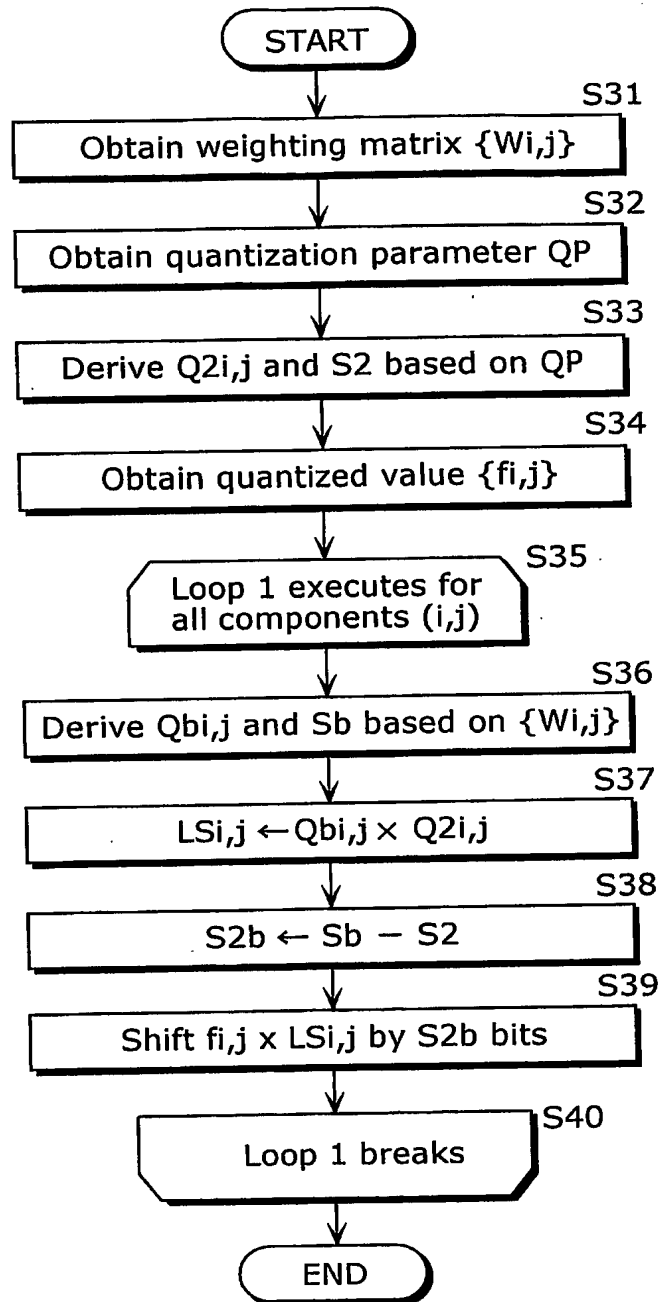
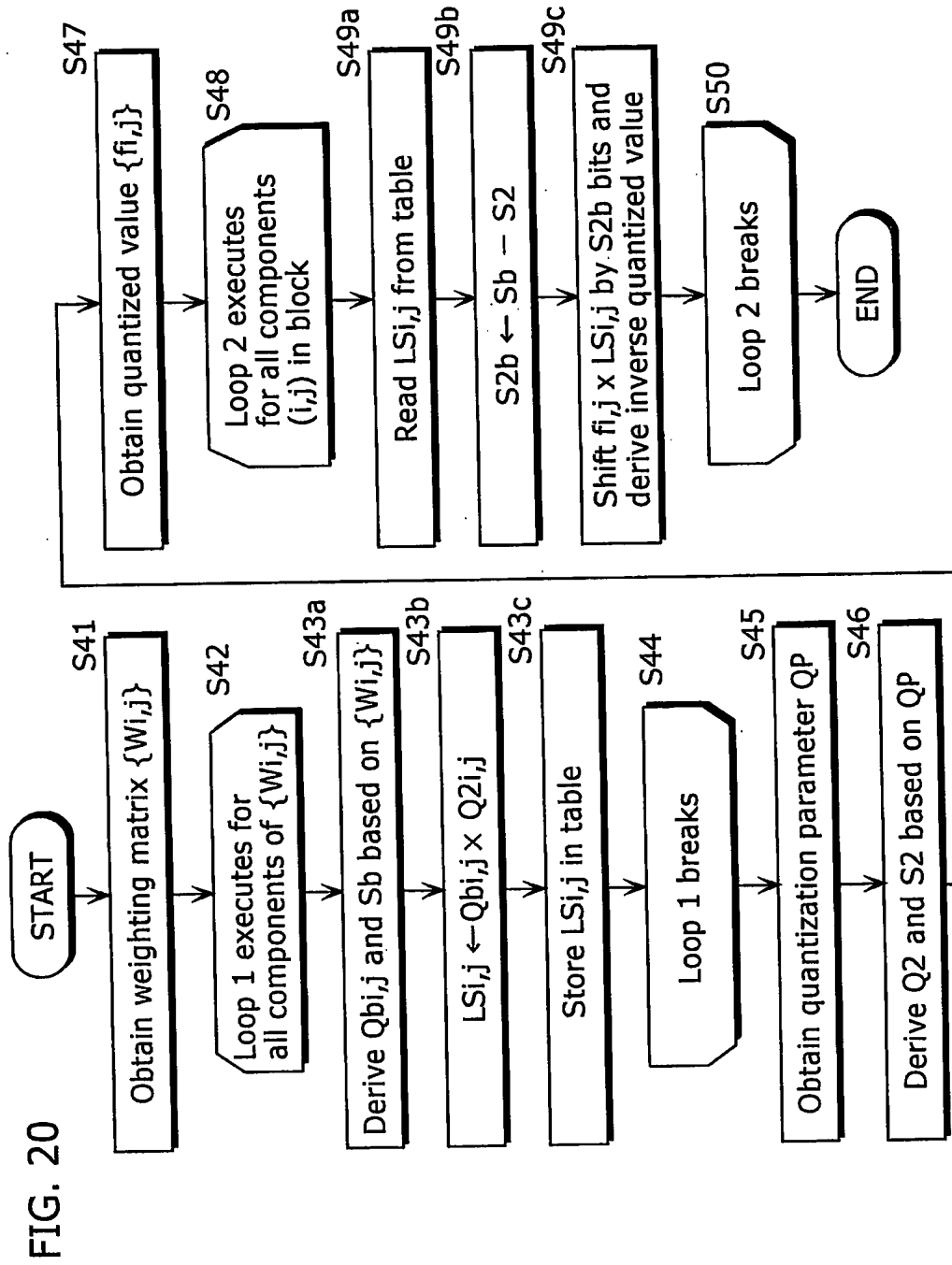
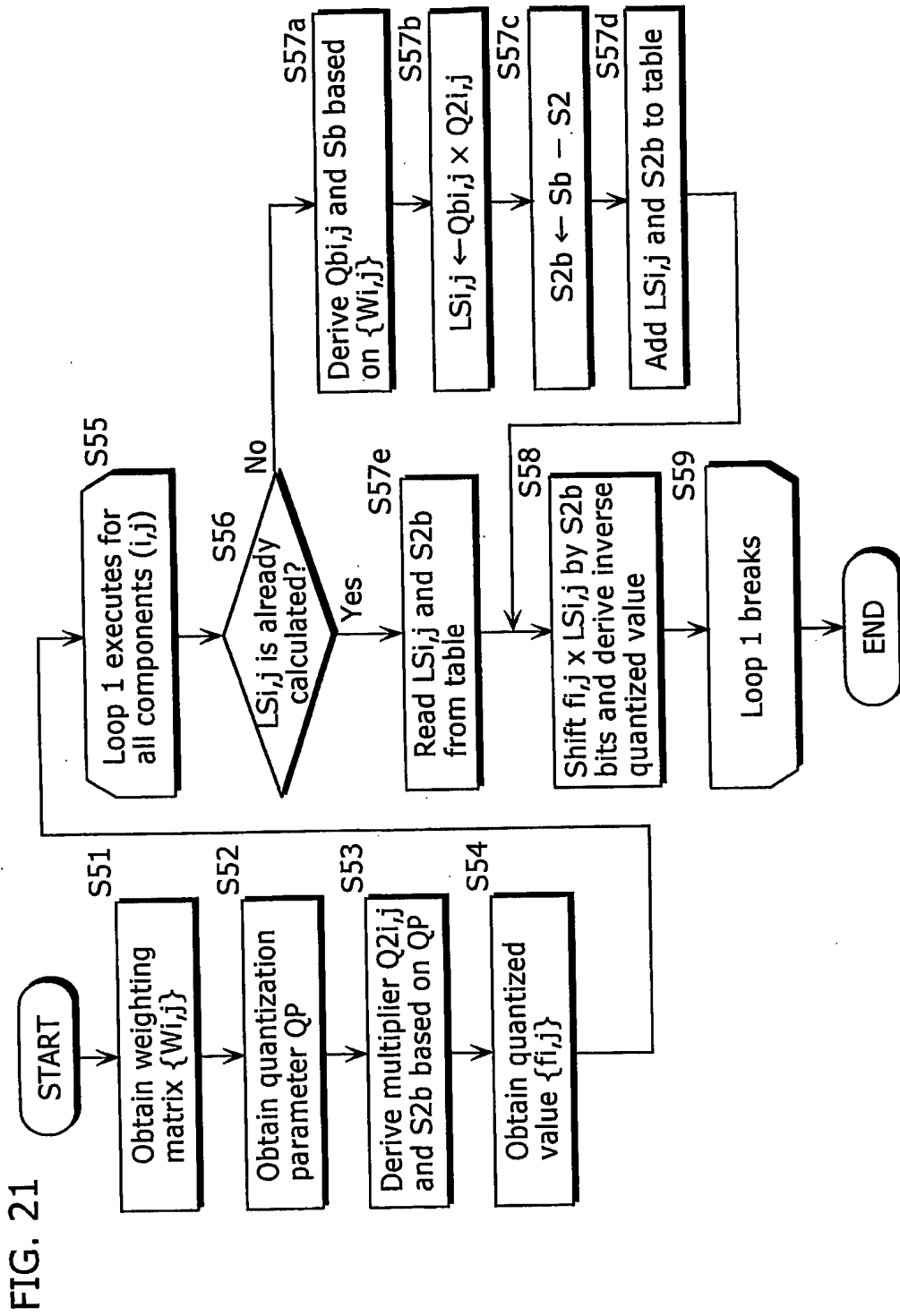
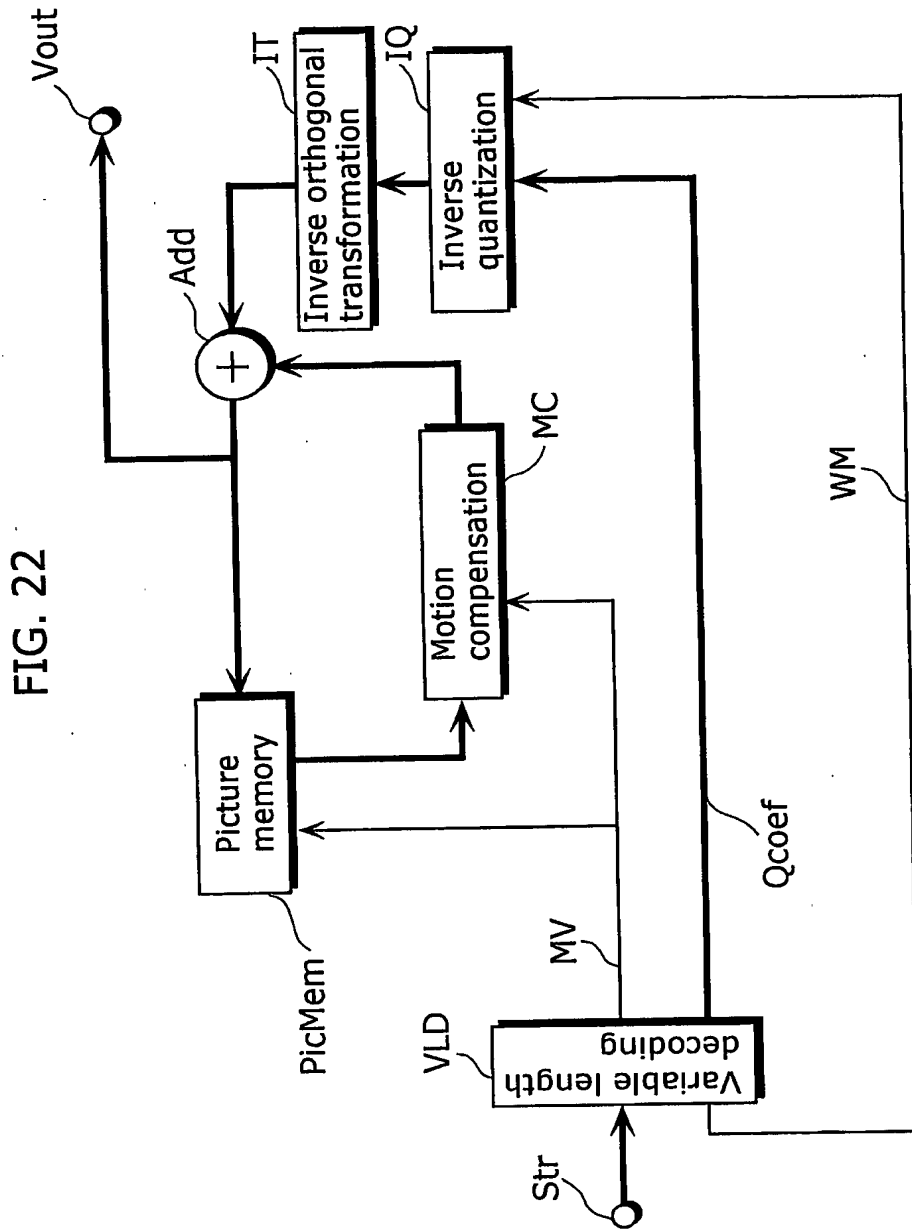


FIG. 19









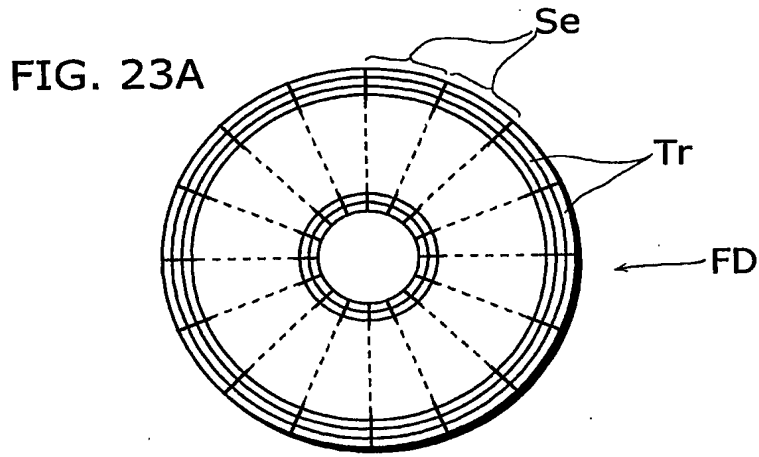


FIG. 23B

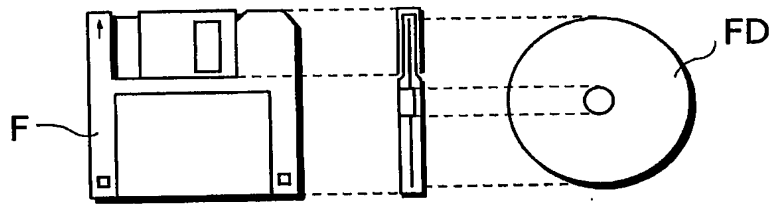
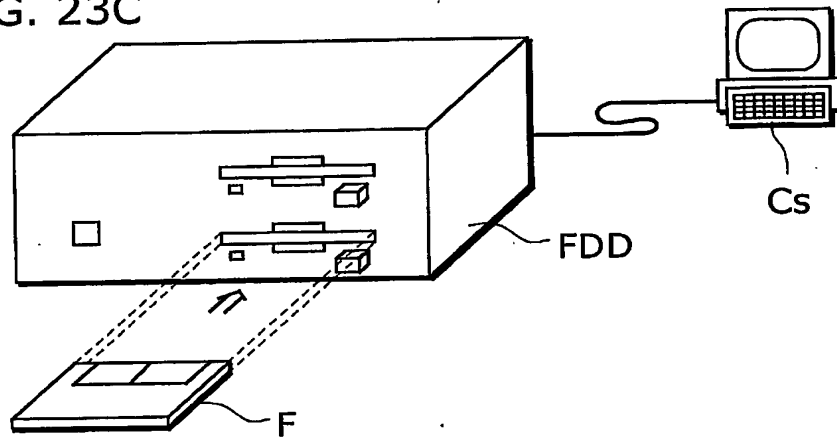


FIG. 23C



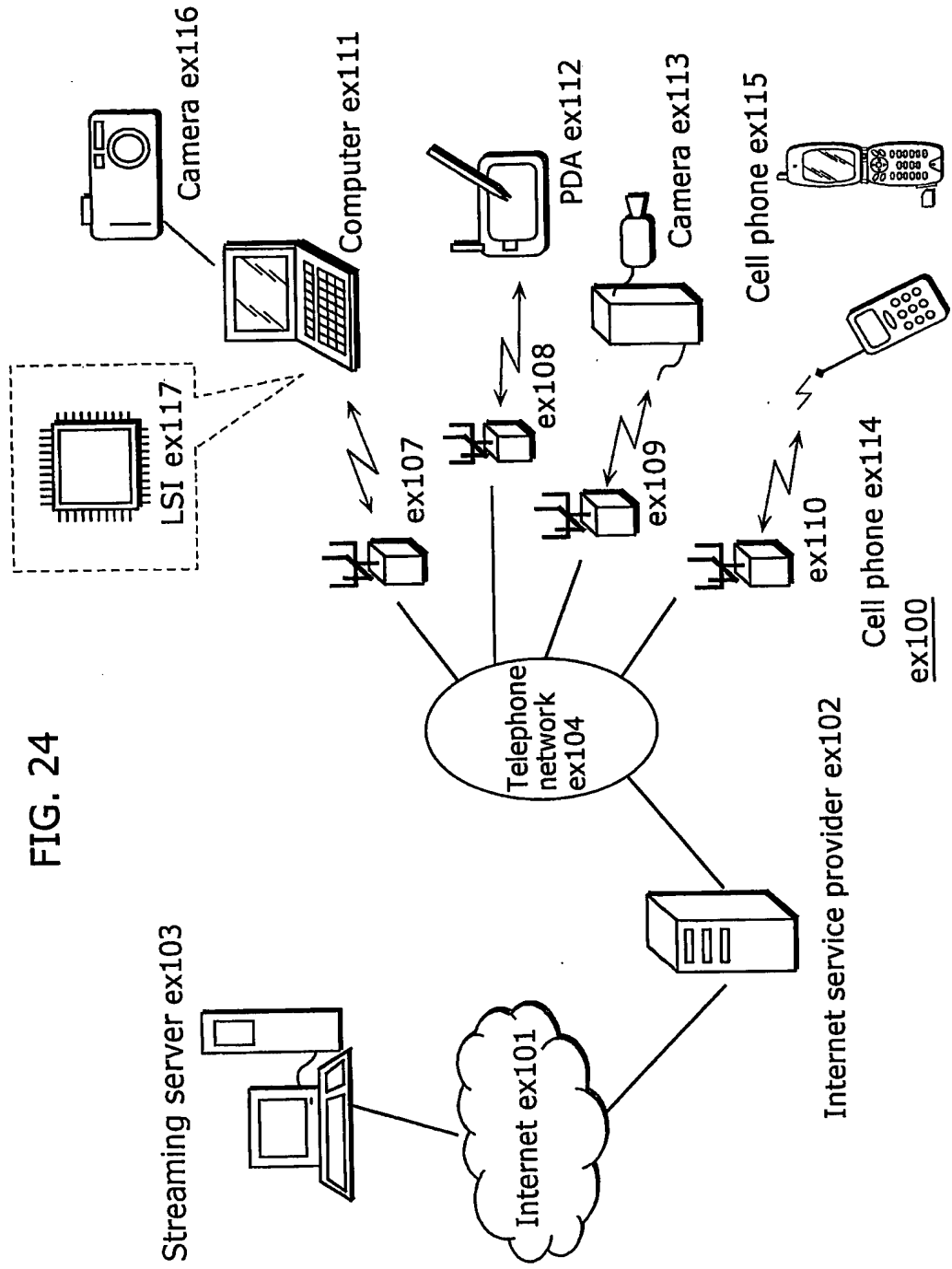
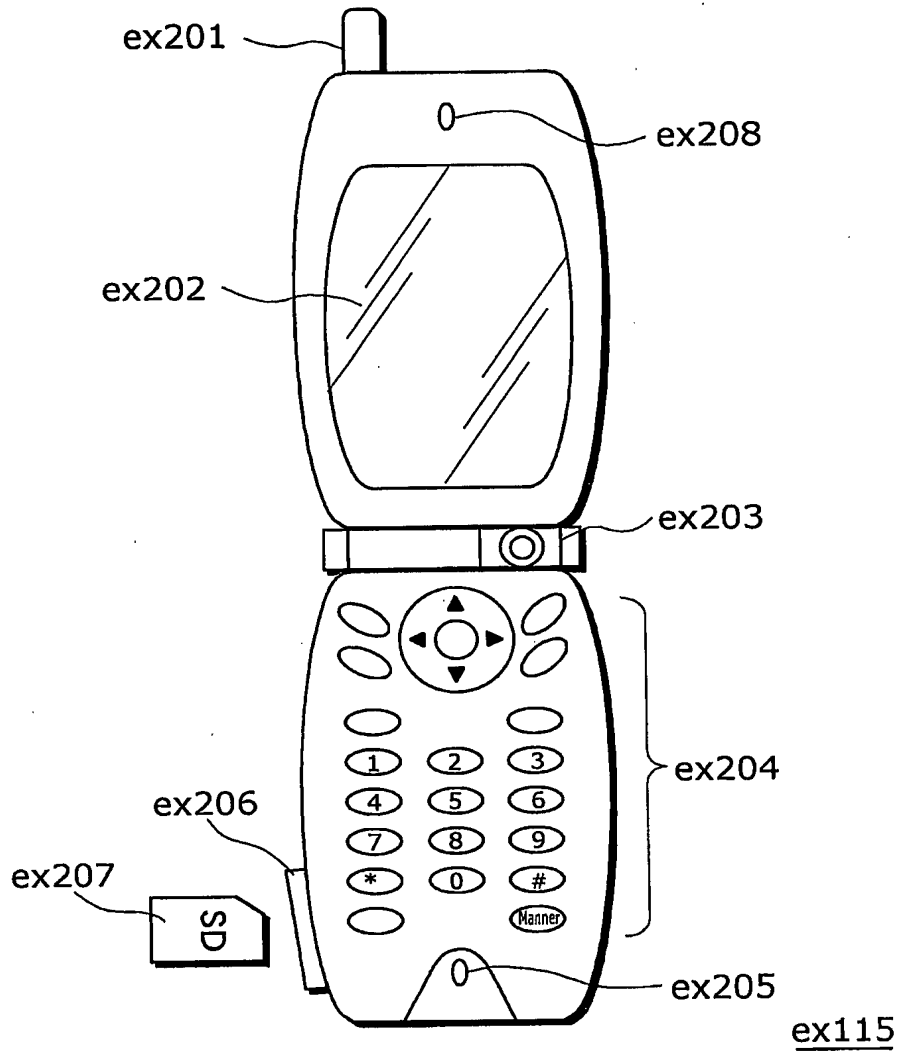


FIG. 24

FIG. 25



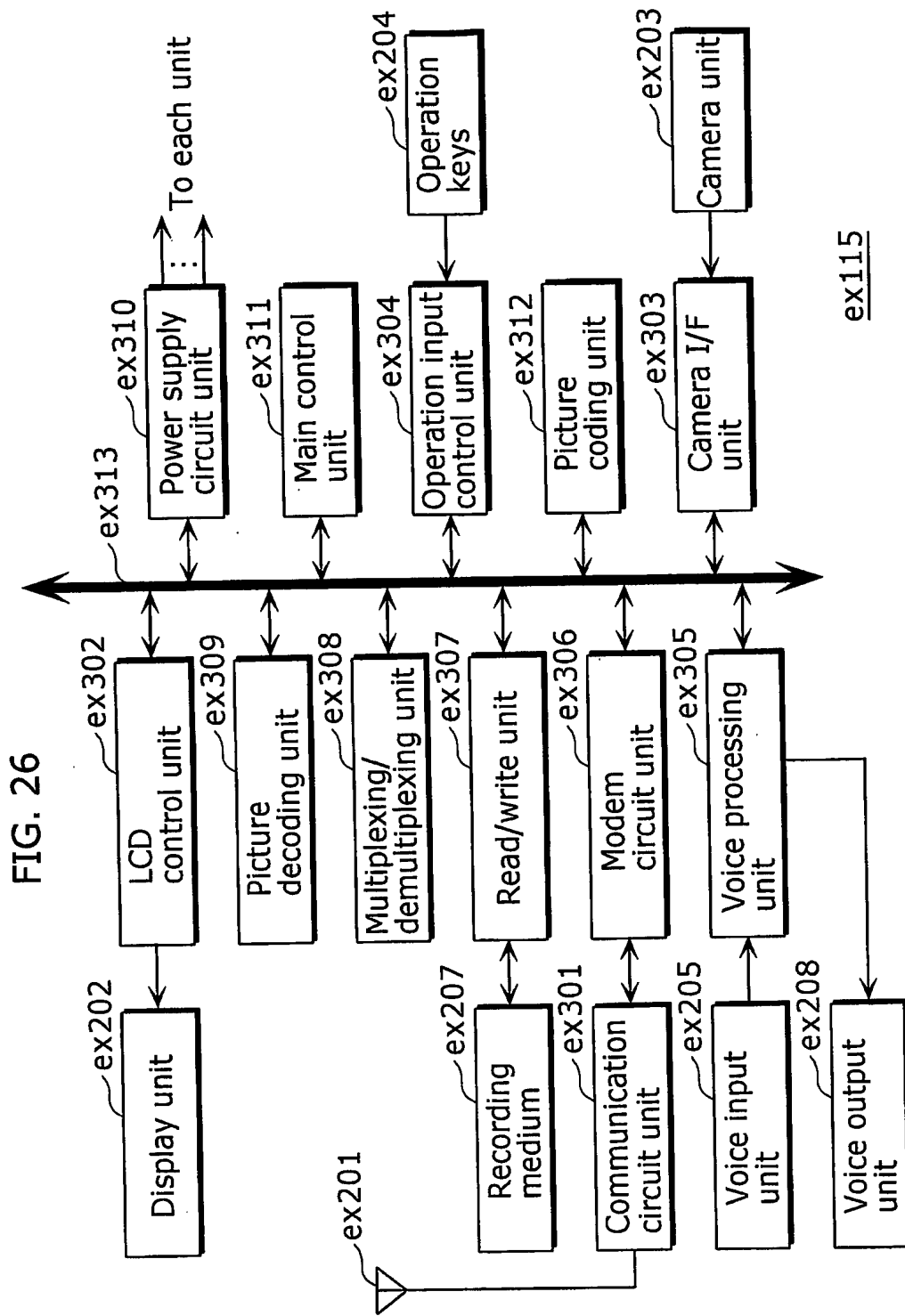


FIG. 26

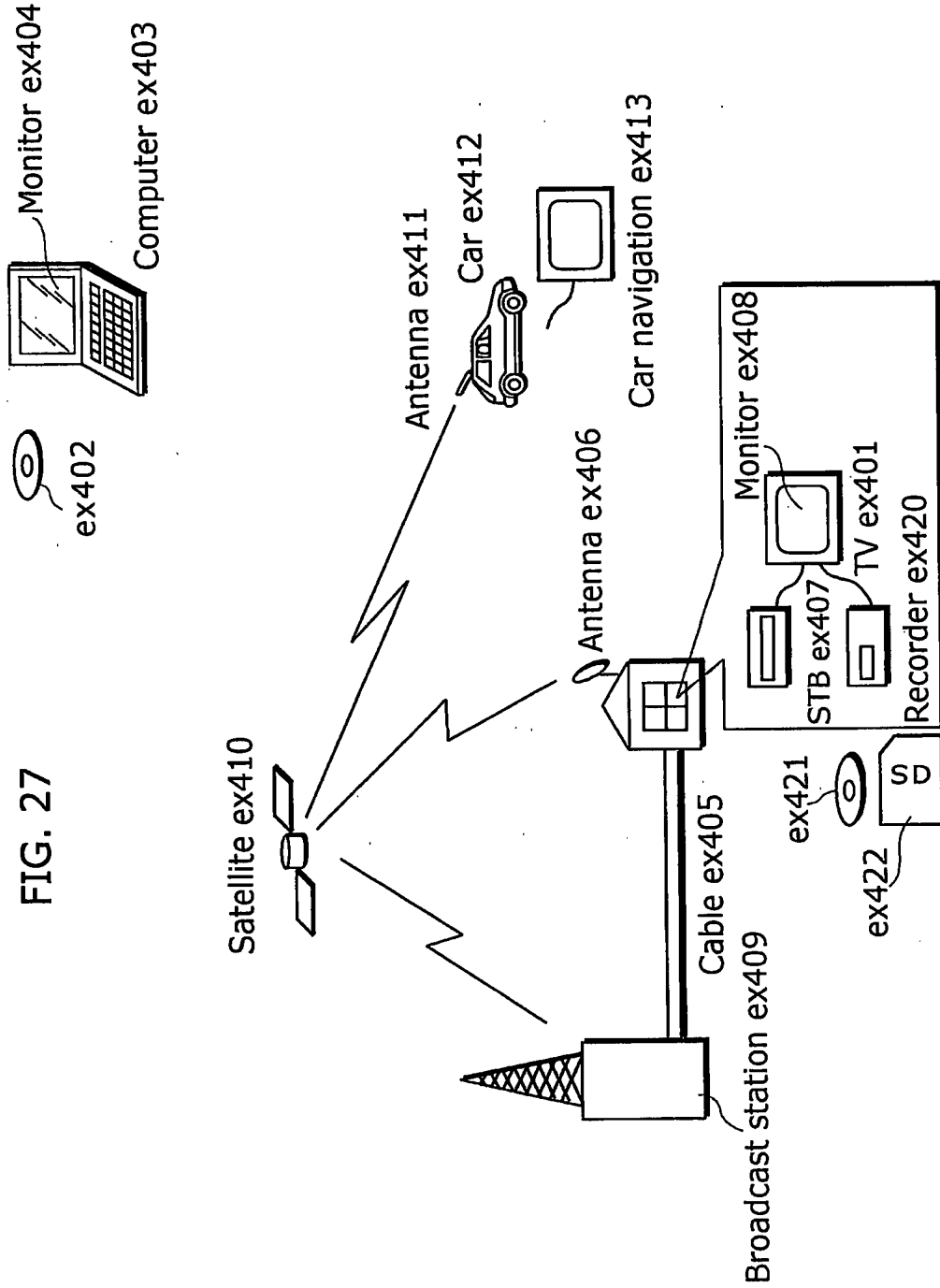


Fig.28

16,16,19,22,26,27,29,34
16,16,22,24,27,29,34,37
19,22,26,27,29,34,34,38
21,22,26,27,29,34,37,40
22,26,27,29,32,35,40,48
26,27,29,32,35,40,48,58
26,27,29,34,38,46,56,69
27,29,35,38,46,56,69,83

Fig.29

W=	2506		15
	2211		17
	1979		19
	1709	V=	22
	1566		24
	1392		27

Fig.30

Quantization matrix Qq (corresponding to Q1a at the encoder):

506624, 506624, 426631, 368454, 311769, 300222, 279517, 238411
506624, 506624, 368454, 337749, 300222, 279517, 238411, 219081
426631, 368454, 311769, 300222, 279517, 238411, 238411, 213315
368454, 368454, 311769, 300222, 279517, 238411, 219081, 202650
368454, 311769, 300222, 279517, 253312, 731600, 202650, 168875
311769, 300222, 279517, 253312, 231600, 202650, 168875, 139758
311769, 300222, 279517, 238411, 213315, 176217, 144750, 117478
300222, 279517, 231600, 213315, 176217, 144750, 117478, 97662

Fig.31

De-quantization matrix Qd (corresponding to Q2b at both the encoder and decoder):

4864, 4864, 5776, 6688, 7904, 8208, 8816, 10336
4864, 4864, 6688, 7296, 8208, 8816, 10336, 11248
5776, 6688, 7904, 8208, 8816, 10336, 10336, 11552
6688, 6688, 7904, 8208, 8816, 10336, 11248, 12160
6688, 7904, 8208, 8816, 9728, 10640, 12160, 14592
7904, 8208, 8816, 9728, 10640, 12160, 14592, 17632
7904, 8208, 8816, 10336, 11552, 13984, 17024, 20976
8208, 8816, 10640, 11552, 13984, 17024, 20976, 25232

Fig.32

16,19,26,29
19,26,29,34
22,27,32,40
26,29,38,56

Fig.33

$$W = \begin{bmatrix} 13107 & 5243 & 8066 \\ 11916 & 4660 & 7490 \\ 10082 & 4194 & 6554 \\ 9362 & 3647 & 5825 \\ 8192 & 3355 & 5243 \\ 7282 & 2893 & 4559 \end{bmatrix} \quad V = \begin{bmatrix} 10 & 16 & 13 \\ 11 & 18 & 14 \\ 13 & 20 & 16 \\ 14 & 23 & 18 \\ 16 & 25 & 20 \\ 18 & 29 & 23 \end{bmatrix}$$

Fig.34

Quantization matrix Qq
(corresponding to Q1a at the encoder):

2580992, 1412904, 1588303, 925696
1412904, 660716, 925696, 505254
1877085, 994266, 1290496, 671130
1032507, 592366, 706452, 306761

Fig.35

De-quantization matrix Qd
(corresponding to Q2b at both the encoder and decoder):

3328, 4864, 5408, 7424
4864, 8320, 7424, 10880
4576, 6912, 6656, 10240
6656, 9280, 9728, 17920

Fig.36

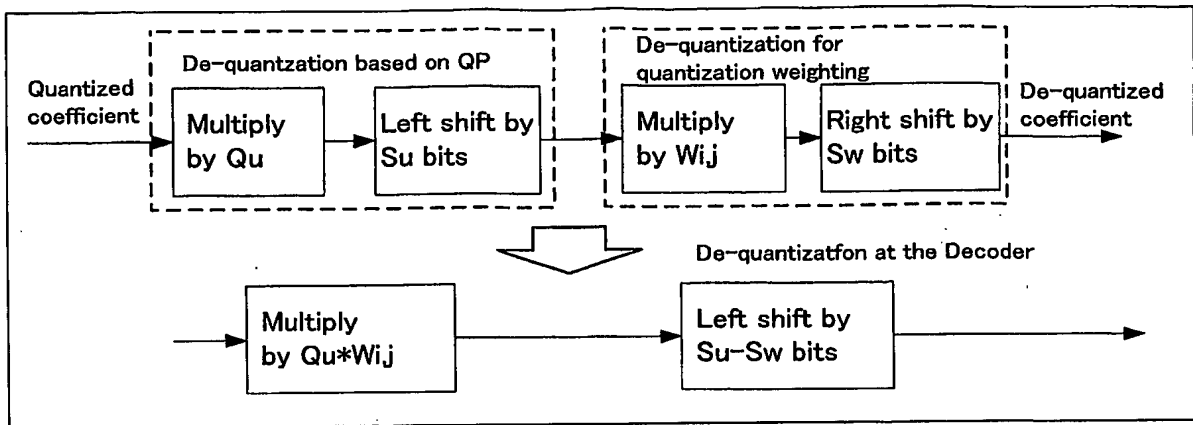


Fig.37

$$W = \begin{bmatrix} 16 & 16 & 19 & 22 & 26 & 27 & 29 & 34 \\ 16 & 16 & 22 & 24 & 27 & 29 & 34 & 37 \\ 19 & 22 & 26 & 27 & 29 & 34 & 34 & 39 \\ 22 & 22 & 26 & 28 & 30 & 35 & 37 & 41 \\ 22 & 26 & 27 & 28 & 33 & 40 & 42 & 49 \\ 26 & 27 & 30 & 32 & 35 & 40 & 48 & 59 \\ 26 & 27 & 31 & 34 & 38 & 46 & 57 & 69 \\ 26 & 29 & 36 & 39 & 45 & 55 & 68 & 78 \end{bmatrix}$$

Fig.38

$$d_{ij} = (c_{ij} * M(QP \% 6, i, j)) \ll (QP / 6 - 4), \quad \text{for } QP / 6 \geq 4. \quad (1)$$

$$d_{ij} = (c_{ij} * M(QP \% 6, i, j)) + 1 \ll ((3 - QP / 6) \gg 4 - QP / 6), \quad \text{for } QP / 6 < 4. \quad (2)$$

where

$$M(QP \% 6, i, j) = W(i, j) * \text{LevelScale}(QP \% 6, i, j) \quad (3)$$

In 8x8 case, we use the definition as defined in Ref.2.

$$\text{LevelScale}(m, i, j) = \begin{bmatrix} 15 \\ 17 \\ 19 \\ 22 \\ 24 \\ 27 \end{bmatrix} \quad (4)$$

d_{ij} is used for inverse transform, where inverse transform is fully defined in Ref.2.

Fig.39

$$\text{LevelScale}(m,i,j) = \begin{cases} Vm0 & \text{for } (i,j) \in \{ (0,0),(0,2),(2,0),(2,2) \}, \\ Vm1 & \text{for } (i,j) \in \{ (1,1),(1,3),(3,1),(3,3) \}, \\ Vm3 & \text{otherwise;} \end{cases}$$

Fig.40

$$V = \begin{bmatrix} 10 & 16 & 13 \\ 11 & 18 & 14 \\ 13 & 20 & 16 \\ 14 & 23 & 18 \\ 16 & 25 & 20 \\ 18 & 29 & 23 \end{bmatrix}$$

Fig.41

$$\begin{bmatrix} 8 & 14 & 20 & 24 & 50 & 50 & 50 & 50 \\ 14 & 15 & 23 & 26 & 50 & 50 & 50 & 50 \\ 19 & 22 & 27 & 31 & 50 & 50 & 50 & 50 \\ 23 & 23 & 28 & 30 & 50 & 50 & 50 & 50 \\ 24 & 28 & 32 & 50 & 50 & 50 & 50 & 50 \\ 34 & 35 & 50 & 50 & 50 & 50 & 50 & 50 \\ 40 & 50 & 50 & 50 & 50 & 50 & 50 & 50 \\ 50 & 50 & 50 & 50 & 50 & 50 & 50 & 50 \end{bmatrix}$$

Fig.42

$$\begin{bmatrix} 2560 & 4256 & 8000 & 7296 & 16000 & 15200 & 20000 & 15200 \\ 4256 & 4320 & 8832 & 7488 & 15200 & 14400 & 19200 & 14400 \\ 7600 & 8448 & 13824 & 11904 & 20000 & 19200 & 25600 & 19200 \\ 6992 & 6624 & 10752 & 8640 & 15200 & 14400 & 19200 & 14400 \\ 7680 & 8512 & 12800 & 15200 & 16000 & 15200 & 20000 & 15200 \\ 10336 & 10080 & 19200 & 14400 & 15200 & 14400 & 19200 & 14400 \\ 16000 & 19200 & 25600 & 19200 & 20000 & 19200 & 25600 & 19200 \\ 2560 & 4256 & 8000 & 7296 & 16000 & 15200 & 20000 & 15200 \end{bmatrix}$$

Fig.43

$$\pi \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \\ 1 & -1 & 1 & -1 \end{bmatrix} \begin{bmatrix} c00 & c01 & c02 & c03 \\ c10 & c11 & c12 & c13 \\ c20 & c21 & c22 & c23 \\ c20 & c31 & c32 & c33 \end{bmatrix} \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \\ 1 & -1 & 1 & -1 \end{bmatrix}$$